THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
BACHELOR OF TECHNOLOGY (MECHANICAL – LEVEL 6)
FINAL EXAMINATION 2007
MEX6331 - AUTOMOBILE ENGINEERING
DATE : 14 MAY 2008 (Wednesday)
TIME : 0930 - 1230
DURATION : Three hours

Instructions. : This question paper consists of two parts. Part A consists of two (02) questions and part B consists of six (06) questions. You are required to answer only five (05) questions selecting at least one (01) question from part A. All questions carry equal marks.

PART A

Question 01

(a) Starting from first principles, show that the air standard efficiency of an engine, working on the Otto cycle is given by

$$\eta = 1 - \frac{1}{r^{\gamma-1}}$$

(b) A four cylinder four-stroke engine was tested for three minutes in a rope brake dynamometer at a speed of 1600 rev/min. A total of 0.714 kg of fuel was consumed. The radius of the brake pulley was 450 mm. The difference in tension on either side of the brake pulley was 435 N. Assuming the bore diameter to be 108 mm, stroke 122 mm and mechanical efficiency 82%, calculate the following. (Take the calorific value of fuel as 42,000 kJ/kg)

(i) Brake thermal efficiency.
(ii) Indicated thermal efficiency.
(iii) Mean effective Pressure.
(iv) Specific fuel consumption.

Question 02.

The following information is available with respect to a single cylinder spark ignition engine.

Bore diameter	110 mm
Stroke length	120 mm
Speed of the engine	3200 rev/min
Volumetric efficiency	80%
Coefficient of discharge of the main jet	0.82
Coefficient of discharge of venturi	0.8
Pressure at the throat	0.88×10^5 N/m^2
Diameter of the emulsion tube	10 mm
Diameter of the main fuel jet	1.3 mm
Fuel level in the float chamber below the top of the main jet	7 mm
Specific gravity of fuel	0.80
Atmospheric pressure	1.02×10^5 N/m^2
Ambient temperature	30^0C
Gas constant for air	0.287 kJ/kg K
Ratio of specific heats for air (γ)	1.4

Calculate the diameter of the venturi (throat) and the air fuel ratio for a four stroke four cylinder, spark ignition engine, fitted with a single jet carburettor.

You may use the following equation to calculate the velocity of flow of air (C_T) at the venture of a carburettor.

$$C_T^2 = \left(\frac{\gamma}{\gamma - 1}\right) RT \left[1 - \left(\frac{P_T}{P}\right)^{\frac{\gamma-1}{\gamma}}\right]$$

where,

T – Ambient temperature
P – Atmospheric pressure
P_T- Pressure at the venturi

PART B

Question 03

(a) Explain the function of the Oxygen sensor as a means of reducing toxic emissions from gasoline engines.
(b) What is a catalytic converter? Explain its functions.
(c) Explain the objective of exhaust gas recirculation as a means of reducing harmful emissions from automobile engines.

Question 04

In the epicyclic gear shown in Figure 4, the pinion A is rigidly fixed to the motor shaft and annular D is fixed. The wheel B gears with A and annular D and gear C meshes with E which is keyed to the machine shaft. The arm rotates about the centre of A and carries the compound wheel BC. Find the speed of the output shaft if the motor runs at 100 rev/min and wheel A has 15 teeth, wheel B has 20 teeth, and pinion C has 15 teeth.

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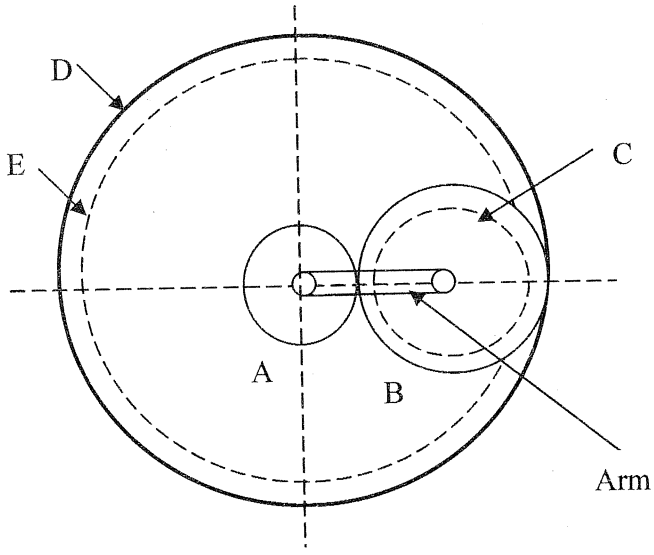


Figure 4

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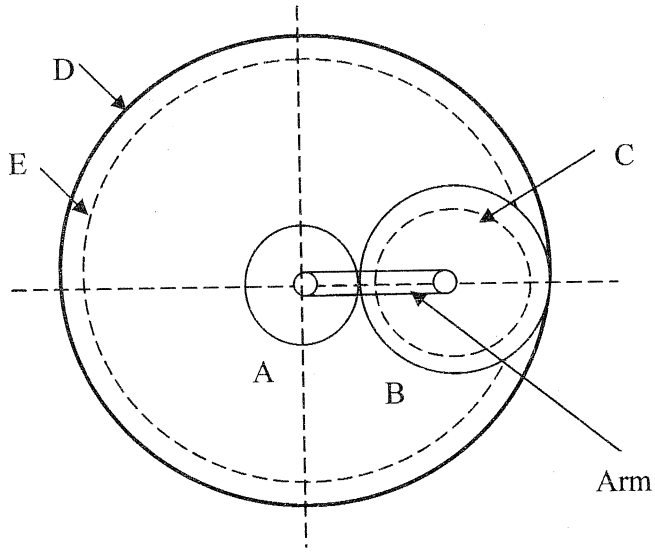


Figure 4

Question 05

Briefly explain the function, construction, and selection of material suitable for operating conditions for the following engine components.

(a) Cylinder block
(b) Piston
(c) Gudgeon pin
(d) Connecting rod
(e) Crank shaft

Question 06

(a) Explain the necessity of an ignition advance mechanism for Spark Ignition engines. (you may use cylinder pressure vs crank angle diagrams for the explanation).
(b) Explain the difference between "piston knock" and "diesel knock".

Question 07

I was discussing the high fuel cost and the mileage my car does per liter of petrol, with one of my friends. He advised me with the following.

Increasing the fuel efficiency is generally a combination of changing driving habits and providing proper maintenance. But when used in combination the savings in fuel costs can be significant.
One way to improve gas mileage is to drive responsibly. Aggressive driving tactics such as, constant lane changing, and racing through yellow lights require the driver to accelerate unnecessarily. Another way to improve gas mileage is to avoid sudden acceleration and speeding.
Other ways to increase gas mileage (fuel efficiency) involve making sure the car itself is properly maintained. Changing out a dirty air filter, for example, should noticeably improve an engine's efficiency, which in turn increases overall gas mileage. A thorough tune-up should also improve gas mileage, especially if fouled spark plugs are replaced. Maintaining proper wheel alignments and tire inflation can also improve gas mileage.

Explain whether these suggestions would reduce the fuel consumption and if so explain briefly on each point.

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